Plasmon

Plasmon M-Series *M500* Optical Disk Library System

SCSI Software Interface Specification

Plasmon IDE

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This publication describes the SCSI software interface to Plasmon's M500 Optical Disk Library System - an automated optical disk cartridge changer. It is intended to provide interfacing information to parties wishing to develop software and/or applications programs for the M500 library system. This document corresponds to product revision level 2.05 or later of the M500 firmware.

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Printing History

Revision	Date	Pages	Descriptions
A	12/18/97		Preliminary.
B	2/2/98	17-28,46-51	Changed Mode Select/ Mode Sense pages; added 10-byte Mode Select and Mode Sense. Changes to Log Sense unit statistics page and Mode Sense Vendor Unique Mode Parameters page. Updated error codes.
C	3/10/98	8,17,24	Added Additional Unit Information page for Inquiry return data. Added global drive options to Mode Select and Mode Sense, and CanOpen and CanClose bits to Mode Sense only Vendor Unique Mode Parameters page.
D	5/7/98	4,12,17,24,49-51	Changed some recommended command timeouts. Added upper main harness cable failure flag to Log Sense Unit Statistics page. Added DASDInq global drive option to Mode Select and Mode Sense Vendor Unique Mode Parameters page. Updated error codes.
E	11/25/98	12, 15,17-19, 25,44,46-51	Added InitReqd bit to Log Sense Unit Statistics page. Added FirstErr, Not1st, and Error Type fields to Log Sense Error Log page. Changed default value for Event History Type field in Mode Select Vendor Unique Mode Parameters page. Added LogInfo bit to Mode Select and Mode Sense Vendor Unique Special Modes page. Added CmdFilter bit to Event History Type and Event Description. Added Slider-load failure to Medium Changer Device SCSI Error Codes, and Drive power disconnected error to SCSI Error Codes and Internal Error Codes.
F	4/7/99	8,12,17-17,21, 24,34,46-51	Added Ph 3 Shafts field to Inquiry Additional Unit Information page. Added LastMTE and FlipSide fields to Log Sense Unit Statistics page. Fixed PF bit default in Mode Select command. Added FastSCSI global drive option to Mode Select and Mode Sense Vendor Unique Mode Parameters page. Added OpnExport bit to Mode Select and Mode Sense Vendor Unique Special Modes page. Corrected description of Data Transfer Element Descriptor NotBus bit. Clarified error codes and locations; added host error recovery procedures.

CONTENTS

1. Introduction

Plasmon's M-Series is a family of optical disk based robotic library systems capable of holding a number of optical disk drives and optical disks. The robotic device within each library system is referred to as a **medium changer device** and it uses the protocols and commands for medium changer devices as defined in the American National Standards Institute SCSI-2 Specification. The M-Series library system's medium changer device and the optical disk drives within the library system are all accessed independently.

There are a number of locations or **elements** within the library system which are capable of holding optical disk media. These consist of the import/export element, the storage elements, the medium transport elements, and the data transfer elements.

The **Import / Export Element,** or **IEE**, is the operator accessible slot through which optical disk cartridges are added to or removed from the library system. It is also known as the mailslot.

The **Storage Elements**, **SE1 - SE*n***, are internal locations within the library system's medium store.

The **Medium Transport Elements**, **MTE1** and **MTE2**, are the optical disk transport mechanisms used to remove optical disks from or return optical disks to the import/export element, the medium store, or the read/write optical drives.

The **Data Transfer Elements**, **DTE1 - DTE*n***, are the read/write optical drives.

The following element addresses have been assigned to the M500 library system:

Element Addresses

Element Type	Element Addresses
SE	1 - n
IEE	4001 (0FA1h)
DTE	6001 - 6000+n (1771h - 1770h+n)
MTE	8001, 8002 (1F41h, 1F42h)

The following SCSI-2 common commands have been implemented for the M500 medium changer device. The use of these commands is discussed in the following sections.

Inquiry
Mode Select
Mode Sense
Send Diagnostic
Rezero Unit
Test Unit Ready
Request Sense
Reserve
Release
Position to Element
Move Medium
Exchange Medium
Open Close Mailslot
Prevent Allow Medium Removal
Initialize Element Status
Read Element Status
Log Sense
Log Select

2. Command Summary

The **Inquiry** command requests medium changer device parameters be sent to the SCSI initiator device.

The **Mode Select (6)** and **Mode Select (10)** commands provide a means of selecting medium changer device parameters.

The **Mode Sense (6)** and **Mode Sense (10)** commands provide a means for reporting medium changer device parameters to the initiator.

The **Send Diagnostic** command provides a means for performing diagnostic tests on the medium changer device.

The **Rezero Unit** command is used to 'reset' the medium changer device.

The **Test Unit Ready** and **Request Sense** commands are necessary to interface the medium changer device.

The **Reserve** and **Release** commands are used to reserve the medium changer device or elements within it for multiple initiator applications. Many implementations will not require these commands.

The **Position to Element** command instructs the medium changer device to position one of the two medium transport elements (MTE's) in front of a data transfer element (optical disk drive) in preparation for a disk cartridge eject from the drive. Optionally, this command can also be used to position an MTE to a particular media storage element location in preparation for a Move Medium or Exchange Medium command.

The **Move Medium** command instructs the medium changer device to move a unit of media from a source element to a destination element (e.g.: move a cartridge from the mailslot to slot SE3). The Invert bit may be specified to flip the cartridge prior to depositing the cartridge into the destination element.

The **Exchange Medium** command instructs the medium changer device to exchange the cartridge in the source element with the cartridge in a destination element and place that cartridge in another destination element. The Invert bit may also be specified.

The **Open Close Mailslot** command instructs the medium changer device to open or close the mailslot thus enabling cartridge insertion or removal.

The **Prevent Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the mailslot for cartridge insertion or removal.

The **Initialize Element Status** command causes the medium changer device to test all elements for the presence of media.

The **Read Element Status** command is used to determine status of elements (e.g.: make a directory of cartridges in the library system).

The **Log Sense** command provides a means for reporting medium changer device statistical and error log information.

The **Log Select** command provides a means of clearing certain unit statistics, error statistics, and error log information.

3. Messages, Status Bytes, and Timeouts

The medium changer device within the library system responds to commands as defined by and in accordance with the ANSI X3.131-1994 specification Small Computer System Interface-2 (also known as SCSI-2). This standard defines a protocol whereby data is transferred between two devices in a sequence of phases. A request is made by sending a Command Descriptor Block (CDB) during the COMMAND phase. For certain commands, the request is accompanied by a list of parameters sent during the DATA OUT phase. Some commands receive data during the DATA IN phase. This document lists the commands and accompanying parameters for the medium changer device.

The interface to the library system is single-ended. Differential SCSI is not supported Synchronous data transfer is not supported; neither is wide or fast data transfer. The medium changer device will never assert the RST (Reset) line and will follow option b of section 6.1.4.2 of the ANSI X3.131-1994 SCSI-2 specification if the initiator does not respond in the reselection phase.

The medium changer device will disconnect from the initiator during a Send Diagnostic, Position to Element, Move Medium, Exchange Medium, Open Close Mailslot, Initialize Element Status, or Rezero Unit command (if disconnection is supported by the initiator) thereby freeing the SCSI bus to allow other I/O processes to occur.

3.1 Supported Messages

In the course of communication between two SCSI devices, messages are sent in the MESSAGE IN and MESSAGE OUT phases. The following messages are accepted by and sent by the medium changer device. The direction field indicates the direction of message transfer. The MESSAGE REJECT message is sent for all unaccepted messages.

Message Codes

Code	Message Name	Direction
06h	ABORT	Out
OCh	BUS DEVICE RESET	Out
00h	COMMAND COMPLETE	In
04h	DISCONNECT	In/Out
80h+	IDENTIFY	In/Out
05h	INITIATOR DETECTED ERROR	Out
09h	MESSAGE PARITY ERROR	Out
07h	MESSAGE REJECT	In/Out
08h	NO OPERATION	Out
Key: In = Target (medium changer device) to Initiator, Out = Initiator to Target (medium changer device) 80h+ = Codes 80h through FFh are used for IDENTIFY messages		

3.2 Status Bytes

A status byte is sent from the medium changer device to the initiator during the STATUS phase at the termination of each command. The supported status byte code values are listed below.

Status Byte Code

Bits of status byte								Status
7	6	5	4	3	2	1	0	
R	R	0	0	0	0	0	R	GOOD
R	R	0	0	0	0	1	R	CHECK CONDITION
R	R	0	0	1	0	0	R	BUSY
R	R	0	1	1	0	0	R	RESERVATION CONFLICT
All other codes								Not Returned
Key: R = Reserved bit								

GOOD. The medium changer device has successfully completed the command.

CHECK CONDITION. Any error, exception, or abnormal condition resulting in sense data being set causes a CHECK CONDITION status. A Request Sense command should be issued following a CHECK CONDITION status to determine the nature of the condition.

BUSY. The medium changer device is busy and cannot accept a command.

RESERVATION CONFLICT. A command has been sent by an initiator to the medium changer device when it is already reserved by another initiator.

3.3 Recommended Command Timeouts

The following values are the recommended timeout values for host software to use when issuing commands the medium changer device. The actual command execution times depend upon the various Mode Settings in effect (see Section 4.6.1), the type of optical drives used, and the number of retries performed to successfully complete a command.

Suggested Timeout Values

SCSI Command	Timeout
Inquiry, Mode Select, Mose Sense, Request Sense, Reserve, Release, Log Select, Prevent Allow Medium Removal	10 sec
Test Unit Ready, Log Sense, Read Element Status	20 sec
Send Diagnostic, Position to Element, Open Close Mailslot	90 sec
Move Medium, Exchange Medium, Rezero Unit, Initialize Element Status	5 min

4. SCSI Commands

4.1 EXCHANGE MEDIUM Command

The **Exchange Medium** command instructs the medium changer device to exchange the cartridge in the source element with the cartridge in a destination element and place that cartridge in another destination element.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A6h)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 3	(MSB)			Transport Element Address				
								(LSB)
4 - 5	(MSB)			Source Element Address				
								(LSB)
6 - 7	(MSB)			First Destination Address				
								(LSB)
8 - 9	(MSB)			Second Destination Address				
								(LSB)
10				Reserved (0)			Inv2	Inv1
11	Reserved (00h)							

The medium in the source element is moved to the first destination element and the medium which previously occupied the first destination element is moved to the second destination element.

Transport Element Address specifies the medium transport element. For the most efficient operation, an address of zero should be used. This will allow the medium changer device to use both medium transport elements to accomplish the cartridge exchange in the least amount of time. A specific medium transport element may also be specified. In this case, however, the second destination element may not be the same as the source element

Source Element Address specifies the source element.

First Destination Address and **Second Destination Address** specify the two destination elements. The first is the destination of the cartridge originally in the Source Element Address. The second is the destination of the cartridge originally in the First Destination Address.

Inv1 and **Inv2** specify the medium should be inverted ("flipped") prior to being deposited in First Destination Address and Second Destination Address, respectively.

Note that since the first medium transport element cannot reach the import/export element in the inverted position, and the second medium transport element cannot reach the import/export element not in the inverted position, not all combinations involving the import/export element will be permitted.

4.2 INITIALIZE ELEMENT STATUS Command

The **Initialize Element Status** command is used to cause the medium changer device to test all elements for the presence of media. The status of each element can then be read using the Read Element Status command. The method by which the storage elements are checked is dependent upon the SlowScan bit in the Mode Select command (see Section 4.6.1). Note: if the SlowScan bit is set and both medium transport elements are full, no statuses will be checked and the command will return an error. Otherwise, the command will proceed as normal but the empty/full status of the Optical Drives will not be checked if both medium transport elements are full, the ChgrEject bit in the Mode Select command is not set, or if

disconnects are not supported by the host. The NoScanSE and NoScanDTE bits in the Mode Select command also affect which elements are checked (see Section 4.6.2).

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 5	Reserved (00h)							

4.3 INQUIRY Command

The **Inquiry** command is issued by the initiator to request medium changer device information.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Logical Unit Number (0)			Reserved (0)				EVPD
2	Page Code							
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

EVPD (Enable Vital Product Data) equals a bit of one if the vital product data page as specified by the Page Code field is to be returned or a bit of zero if standard Inquiry data is to be returned.

Page Code defines the parameter page for vital product to be returned. A value of zero, 80h, or C0h must be used. These pages are described following the Standard Inquiry Data Format.

Allocation Length specifies how many bytes of data are to be returned.

The following page details the standard Inquiry Data Format for an Allocation Length of 45.

Standard INQUIRY Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	RMB (1)	Device-Type Qualifier (0)						
2	ISO Version (0)		ECMA Version (0)			ANSI-Approved Version (2)		
3	AENC (0)	TrmIOP (0)	Reserved (0)		Response Data Format (2)			
4	Additional Length (33h)							
5 - 6	Reserved (00h)							
7	RelAdr(0)	Wbus32(0)	Wbus16(0)	Sync(0)	Linked(0)	Reserved(0)	CmdQue(0)	SftRe(0)
8 - 15	Vendor Identification (“IDE ”)							
16 - 31	Product Identification (“MULTI “)							
32 - 35	Product Revision Level (e.g.,”200 “)							
36 - 43	Manufacturer Id (“IDEMPLS.”)							
44	Model Identification (‘5’)							

Peripheral Qualifier equals zero indicating connection to a logical unit, or 3h indicating an invalid Logical Unit Number.

Peripheral Device Type equals 08h indicating a medium changer device, or 1Fh indicating an invalid Logical Unit Number.

RMB (Removable Media Bit) equals bit of one indicating medium is removable.

ANSI-Approved Version equals 2 indicating compliance with SCSI-2 Specification.

AENC (Asynchronous Event Notification) equals bit of zero indicating no support of this feature.

TrmIOP (Terminate I/O Process) equals a bit of zero indicating no support of this feature.

Response Data Format equals 2 indicating compliance with SCSI-2 Specification.

Additional Length equals 33h.

RelAdr (Relative Address) equals zero indicating no support of this feature.

WBus32 (Wide Bus - 32 bit) equals zero indicating no support of this feature.

WBus16 (Wide Bus - 16 bit) equals zero indicating no support of this feature.

Sync (Synchronous Data Transfers) equals zero indicating no support of this feature.

Linked (Linked Commands) equals zero indicating no support of this feature.

CmdQue (Command Queueing) equals zero indicating no support of this feature.

SftRe (Soft Reset) equals zero indicating the device responds to the RESET condition with the hard RESET alternative.

Vendor Identification is “IDE “.

Product Identification is “MULTI “.

Product Revision Level starts with “201 “ (2.01).

Model Identification is '5' (35h).

4.3.1 Supported Vital Product Data Pages Page (00h)

The Supported Vital Product Data Pages Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	Page Code (00h)							
2	Reserved (00h)							
3	Page Length (03h)							
4	1st Supported Page (00h)							
5	2nd Supported Page (80h)							
6	3rd Supported Page (C0h)							

4.3.2 Unit Serial Number Page (80h)

The Unit Serial Number Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	Page Code (80h)							
2	Reserved (00h)							
3	Page Length (06h)							
4 - 9	Product Serial Number							

Product Serial Number is a six character ASCII representation of the library system's Factory Serial Number. The least significant digit of the serial number is in byte 9.

Peripheral Qualifier and Peripheral Device Type are as in the Standard Inquiry Data Format.

4.3.3 Additional Unit Information Page (C0h)

The Additional Unit Information Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier (0)			Peripheral Device Type (08h)				
1	Page Code (C0h)							
2	Reserved (00h)							
3	Page Length (28h)							
4	Library Generation (1 or 2)							
5	Library Development Level (2)							
6				Hardware Flags				Ph 3 Shafts
7 - 8	(MSB)			Total Number of Cartridge Slots (500)				
								(LSB)
9	Maximum Number of Drives Supported							
10	Number of Library Columns (5)							
11	Number of Slots in Column 1 (103)							
12	Number of Slots in Column 2 (97)							
13	Number of Slots in Column 3 (98)							
14	Number of Slots in Column 4 (98)							
15	Number of Slots in Column 5 (104)							
16 - 17	Reserved (00h)							
18 - 27	EPROM 1 Firmware Part Number (“898821-000”)							
28 - 37	EPROM 2 Firmware Part Number (“898822-000”)							
38 - 39	(MSB)			EPROM 1 Firmware Checksum				
								(LSB)
40 - 41	(MSB)			EPROM 2 Firmware Checksum				
								(LSB)
42 - 43	Reserved (00h)							

Ph 3 Shafts equals a bit of one if the library is configured for phase 3 lift shafts.

4.4 LOG SELECT Command

The **Log Select** command provides a means of clearing certain unit statistics, error statistics, and error log information.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Ch)							
1	Logical Unit Number (0)			Reserved (0)			PCR (0)	SP (1)
2	PC (1)		Reserved (0)					
3 - 6	Reserved (00h)							
7 - 8	(MSB)		Parameter List Length					
								(LSB)
9	Reserved (00h)							

PCR (Parameter Code Reset) equals a bit of zero indicating that not all log parameters are to be reset. Certain parameters, such as the total power-on hours and drive load counts, cannot be reset.

SP (Save Parameters) equals a bit of one indicating that all parameter value changes are to be saved in non-volatile memory.

PC (Page Control) equals a bit of one indicating that current cumulative values are to be affected.

Parameter List Length specifies the length in bytes of the Log Select parameters list.

The Log Select parameter list consists of one or more of the following supported pages.

4.4.1 Unit Statistics Page (30h)

The Unit Statistics Page for the Log Select command is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (30h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (5Ah)					
								(LSB)
4 - 9	Reserved (00)							
10 - 12	(MSB)		Drive 1 Load Count					
								(LSB)
13 - 15	(MSB)		Drive 2 Load Count					
								(LSB)
16 - 18	(MSB)		Drive 3 Load Count					
								(LSB)
19 - 21	(MSB)		Drive 4 Load Count					
								(LSB)
22 - 24	(MSB)		Drive 5 Load Count					
								(LSB)
25 - 27	(MSB)		Drive 6 Load Count					
								(LSB)
28 - 30	(MSB)		Drive 7 Load Count					
								(LSB)
31 - 33	(MSB)		Drive 8 Load Count					
								(LSB)
34 - 36	(MSB)		Drive 9 Load Count					
								(LSB)

Bit Byte	7	6	5	4	3	2	1	0
37 - 39	(MSB)			Drive 10 Load Count				
								(LSB)
40 - 42	(MSB)			Drive 11 Load Count				
								(LSB)
43 - 45	(MSB)			Drive 12 Load Count				
								(LSB)
46 - 93	Reserved (00h)							

If any of the **Drive 1-12 Load Count** fields is equal to zero, the load count of the corresponding drive will be set to zero.

4.4.2 Error Statistics Page (31h)

The Error Statistics Page for the Log Select command is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (31h)					
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (64h)				
								(LSB)
4 - 103	Most Frequent Error Parameters (00h)							

Most Frequent Error Parameters must be equal to a block of all zeros resetting all error statistics information.

4.4.3 Error Log Page (32h)

The Error Log Page for the Log Select command is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (32h)					
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (A0h)				
								(LSB)
4 - 163	Most Recent Error Parameters							

Most Recent Error Parameters must be equal to a block of all zeros resetting all error log information.

4.4.4 Event History Page (33h)

The Event History Page for the Log Select command is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (33h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (02h)					
								(LSB)
4 - 5	(MSB)		Number of Events Recorded (00h)					
								(LSB)

Number of Events Recorded must equal zero clearing all event history information.

4.5 LOG SENSE Command

The **Log Sense** command provides a means for reporting medium changer device statistical and error log information.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Dh)							
1	Logical Unit Number (0)			Reserved (0)			PPC (0)	SP (0)
2	PC (1)		Page Code					
3 - 6	Reserved (00h)							
7 - 8	(MSB)		Allocation Length					
								(LSB)
9	Reserved (00h)							

Page Code defines the parameter page to be returned. A value of zero, 30h, 31h, 32h, or 33h must be used. The corresponding page as described below is returned.

Allocation Length specifies how many bytes of data are to be returned.

4.5.1 Supported Log Pages Page (00h)

The Supported Log Pages Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (00h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (05h)					
								(LSB)
4	1st Supported Page (00h)							
5	2nd Supported Page (30h)							
6	3rd Supported Page (31h)							
7	4th Supported Page (32h)							
8	5th Supported Page (33h)							

4.5.2 Unit Statistics Page (30h)

The Unit Statistics Page for the Log Sense command is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)			Page Code (30h)				
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (5Ah)				
								(LSB)
4 - 6	(MSB)			Total Power-On Hours				
								(LSB)
7 - 9	(MSB)			Cumulative Cycle Count				
								(LSB)
10 - 12	(MSB)			Drive 1 Load Count				
								(LSB)
13 - 15	(MSB)			Drive 2 Load Count				
								(LSB)
16 - 18	(MSB)			Drive 3 Load Count				
								(LSB)
19 - 21	(MSB)			Drive 4 Load Count				
								(LSB)
22 - 24	(MSB)			Drive 5 Load Count				
								(LSB)
25 - 27	(MSB)			Drive 6 Load Count				
								(LSB)
28 - 30	(MSB)			Drive 7 Load Count				
								(LSB)
31 - 33	(MSB)			Drive 8 Load Count				
								(LSB)
34 - 36	(MSB)			Drive 9 Load Count				
								(LSB)
37 - 39	(MSB)			Drive 10 Load Count				
								(LSB)
40 - 42	(MSB)			Drive 11 Load Count				
								(LSB)
43 - 45	(MSB)			Drive 12 Load Count				
								(LSB)
46	OverTemp	Rsvd(0)	MainHUpr	TermPwr	PivotCable	MainHLwr	LiftCable	DoorOpen
47	Reserved(0)	Drv I/F1 Disc	Drv 6 Disc	Drv 5 Disc	Drv 4 Disc	Drv 3 Disc	Drv 2 Disc	Drv 1 Disc
48	Reserved(0)	Drv I/F2 Disc	Drv 12 Disc	Drv 11 Disc	Drv 10 Disc	Drv 9 Disc	Drv 8 Disc	Drv 7 Disc
49	InitReqd	LastMTE		FlipSide	Low Pwr 4	Low Pwr 3	Low Pwr 2	Low Pwr 1
50 - 53	(MSB)			Cumulative Lift Movement Count				
								(LSB)
54 - 57	(MSB)			Cumulative Slider Movement Count - Slider 1				
								(LSB)
58 - 61	(MSB)			Cumulative Slider Movement Count - Slider 2				
								(LSB)
62 - 65	(MSB)			Cumulative Change of Slider in Use Count				
								(LSB)
66 - 69	(MSB)			Cumulative Pivot Movement Count				
								(LSB)
70 - 73	(MSB)			Cumulative Mailslot Open Count				
								(LSB)

Bit Byte	7	6	5	4	3	2	1	0
74 - 77	(MSB)			Cumulative Flip Count				
								(LSB)
78 - 81	(MSB)			Cumulative Lift Up/Down Distance Count				
								(LSB)
82 - 85	(MSB)			Cumulative Slider In/Out Distance Count				
								(LSB)
86 - 89	(MSB)			Cumulative Pivot Left/Right Rotation Count				
								(LSB)
90 - 93	Reserved (00h)							

DoorOpen equals a bit of one if one of the front access doors is open.

LiftCable equals a bit of one if the cable to the lift is faulty or not connected.

MainHLwr equals a bit of one if the lower main harness cable is faulty or not connected.

PivotCable equals a bit of one if the cable to the pivot is faulty or not connected.

TermPwr equals a bit of one if SCSI bus terminator power is low.

MainHUpr equals a bit of one if the upper main harness cable is faulty or not connected.

OverTemp equals a bit of one if the cabinet is above safe operating temperature for the drives.

Drv 1-12 Disc equals a bit of one if the interface cable to the corresponding drive is not properly connected.

Drv I/F1 Disc equals a bit of one if the drive interface board for drives 1-6 is not properly connected.

Drv I/F2 Disc equals a bit of one if the drive interface board for drives 7-12 is not properly connected.

InitReqd equal a bit of one if the next SCSI command using the library's robotics will cause the library to initialize itself before performing the command. This is usually the case after a hardware error in which the library is unable to return cartridges to their source locations and restore itself to its original state.

LastMTE contains the number of the last medium transport element used — 1 or 2.

FlipSide contains the number of the currently active flipper side — 0 or 1.

Low Pwr 1-4 equals a bit of one if the DC power output of the corresponding power supply is low.

The **Cumulative Lift Movement Count** is incremented every time the medium transport element is moved vertically (up or down).

The **Cumulative Slider Movement Counts - Sliders 1,2** are incremented every time the corresponding medium transport element is moved horizontally (in or out).

The **Cumulative Change of Slider in Use Count** is incremented every time the slider in use is changed. An Exchange Medium command, for example, typically requires three changes of slider.

The **Cumulative Pivot Movement Count** is incremented every time the lift assembly is pivoted to reach another column of slots or drives, or the mailslot.

The **Cumulative Mailslot Open Count** is incremented every time the mailslot is opened.

The **Cumulative Flip Count** is incremented every time a cartridge is inverted ("flipped").

The **Cumulative Lift Up/Down Distance Count** is incremented by the distance traveled every time the medium transport element is moved vertically (up or down). The count is in units of meters.

The **Cumulative Slider In/Out Distance Count** is incremented by the distance traveled every time either medium transport element is moved horizontally (in or out). The count is in units of meters.

The **Cumulative Pivot Left/Right Rotation Count** is incremented by the angular distance traveled every time the medium transport element is rotated (left or right). The count is in units of radians.

See the M500 Library System User's Guide or Service Manual for further information about these values.

4.5.3 Error Statistics Page (31h)

The Error Statistics Page for the Log Sense command is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (31h)					
1	Reserved (00h)							
2 - 3	(MSB)		Page Length (64h)					
								(LSB)
4 - 13	First Most Frequent Error Parameters							
14 - 23	Second Most Frequent Error Parameters							
	:							
94 - 103	Tenth Most Frequent Error Parameters							

Each set of most frequent error parameters contains error rate information for one of the most frequently occurring errors. The format of these error parameters is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Error Code							
1 - 2	(MSB)		Error Count					
								(LSB)
3 - 4	(MSB)		Number of Recoverable Errors					
								(LSB)
5 - 6	(MSB)		Number of Unrecoverable Errors					
								(LSB)
7 - 9	(MSB)		Timestamp of Last Occurrence					
								(LSB)

The error codes are listed in Section 6.2. Only hardware errors are recorded. The timestamp is the number of power-on hours at occurrence.

4.5.4 Error Log Page (32h)

The Error Log Page for the Log Sense command is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)			Page Code (32h)				
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (A0h)				
								(LSB)
4 - 19	First Most Recent Error Parameters							
20 - 35	Second Most Recent Error Parameters							
	:							
148-163	Tenth Most Recent Error Parameters							

Each set of most recent error parameters contains information for one of the most recently occurring errors. The format of these error parameters is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Error Code							
1	Initiating Command							
2 - 3	(MSB)			Source Element Address				
								(LSB)
4 - 5	(MSB)			Destination Element Address				
								(LSB)
6	FirstErr	Not1st		Error Type		MTE Number		Invert
7 - 8	(MSB)			Lift Position Element Address				
								(LSB)
9 - 10	(MSB)			Recurrence Count				
								(LSB)
11 - 13	(MSB)			Timestamp of Last Occurrence				
								(LSB)
14 - 15	Additional Information							

The error codes are listed in Section 6.2. If the same error occurs a number of times in sequence, only information for the most recent error is listed. The recurrence count is incremented accordingly.

Initiating Command is the operation code of the SCSI command which initiated the operation or FFh if the error occurred while in maintenance mode or FEh if the error occurred in setup mode.

Source Element Address and **Destination Element Address** are the source and destination addresses for the Position to Element, Move Medium, and Exchange Medium commands. For the Exchange Medium command, these represent either the Source and First Destination Addresses, the First and Second Destination Address or some other intermediate addresses.

FirstErr bit will be set if this was the first error that occurred for a command. This field will only be returned if the LogInfo bit is set along with the SetOptions bit in the Mode Select Vendor Unique Special Modes Page (see Section 4.6.2).

Not1st bit will be set if this was not the first error that occurred for a command and the error might be related to earlier errors (subsequent Error Log pages). This field will only be returned if the LogInfo bit is set along with the SetOptions bit in the Mode Select Vendor Unique Special Modes Page (see Section 4.6.2).

Error Type indicates the type of error and the format of the Additional Information field. The error types are as follows: 1=general error–no additional information, 2=slider related–first Additional Information

byte contains the slider number, 3=column related–first Additional Information byte contains the column number, 4=drive related–first Additional Information byte contains the drive number, 5=drive SCSI related–first Additional Information bytes contain an ASC/ASCQ or an error code of F1h-FFh and a low-level SCSI error location, 6=power supply related–first Additional Information byte contains the power supply number, or 7=drive control board related–first Additional Information byte contains the drive control board number. This field will only be returned if the LogInfo bit is set along with the SetOptions bit in the Mode Select Vendor Unique Special Modes Page (see Section 4.6.2).

MTE Number is the number of the medium transport element (1 or 2) in use when the error occurred.

Invert equals a bit of one for the Move Medium and Exchange Medium commands if the medium was to be inverted ("flipped") prior to being deposited in the destination element.

Lift Position Element Address is the address of the element at which the medium transport element specified by the Medium Transport Element Number was positioned when the error occurred.

Recurrence Count is a count of the number of consecutive times that the error occurred, including retries, with all other information being identical between instances. The total of these identical instances is recorded as one log entry.

Additional Information contains such information as the value of ASC and ASCQ received from the drive in the event of an eject failure when the ChgrEject mode of operation is enabled or the drive not becoming ready when the WaitLoad mode of operation is enabled (see the Mode Select command), or other errors as indicated by ErrorType above. For low-level SCSI errors (error codes F1h and greater) the first byte contains the error number and the second byte contains the low-level SCSI error location. The error codes are listed in Section 6.2 and the error locations are listed in Section 6.4.

4.5.5 Event History Page (33h)

The Event History Page for the Log Sense command is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)			Page Code (33h)				
1	Reserved (00h)							
2 - 3	(MSB)			Page Length (0802h)				
								(LSB)
4 - 5	(MSB)			Number of Events Recorded				
								(LSB)
6 - 2053	Event List							

Number of Events Recorded is the number of significant bytes in the Event List.

Event List is a list of events from most recent to least recent within the library system. The contents of this list is determined by the Event History Type field of the Vendor Unique Modes Parameters Page of the Mode Select command (see Section 4.6.1). For a description of possible events within this list see Section 5. This list may be helpful to technical support personnel in diagnosing problems with the library system.

4.6 MODE SELECT (6) Command

The **Mode Select (6)** command provides a means for the initiator to select medium changer device parameters.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Logical Unit Number (0)			PF (1)	Reserved (0)			SP
2 - 3	Reserved (00h)							
4	Parameter List Length							
5	Reserved (00h)							

PF (Page Format) equals a bit of one indicating that parameters are structured as pages of related parameters.

SP (Save Pages) equals a bit of one if the target is to save changeable parameters in pages, i.e., if values are to be saved to non-volatile memory. If this bit is zero, values are not saved when power is cycled to the library or when it receives a Bus Device Reset message or the SCSI Reset line is asserted.

Parameter List Length specifies the length in bytes of the Mode Select (6) parameter list.

The Mode Select (6) parameter list consists of a 4 byte header followed by one or more of the medium changer device's supported pages. The header is shown below followed by the supported pages.

Mode Select (6) Mode Parameter Header

Bit Byte	7	6	5	4	3	2	1	0
0	Mode Data Length (00h)							
1	Medium Type (00h)							
2	Device-Specific Parameter (00h)							
3	Block Descriptor Length (00h)							

4.6.1 Vendor Unique Mode Parameters Page (20h)

The Mode Select Vendor Unique Mode Parameters Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (20h)					
1	Parameter Length (08h)							
2	ReportRec	SlowScans	LimitRec	ChgrEject	Rsvd (0)	WaitLoad	IgnParity	Park
3	Reserved (0)			SetDr1-6	Loaded	Drive Number		
4	SetNBus	Reserved (0)		SetDr7-12	Rsvd (0)	Number of Buses		
5	Reserved (00h)							
6	SetDrOpt	Reserved (0)			FastSCSI	DASDInq	FVerOnWr	WrCaEnab
7	Reserved (00h)							
8	SetType	Reserved (0)						
9	Event History Type							

ReportRec equals a bit of one if the medium changer device is to return CHECK CONDITION status and set Request Sense data for all recoverable hardware errors, or zero if the device is to return GOOD status

for all recoverable hardware errors. If this bit is set and a recoverable error occurs on a subsequent command, then the Request Sense sense key will be set to RECOVERED ERROR and the ASC and ASCQ fields will be set accordingly. The default for this bit is zero.

SlowScans equals a bit of one if the medium changer device is to use tactile feedback rather than retro-reflective sensors to sense the empty/full status of storage elements for the Initialize Element Status command. Setting this bit may be necessary depending upon the type of media used. As an example, some cartridge shells may be difficult to detect with sensors due to variations in color and reflectivity. Setting this bit slows down the element scan appreciably. The default for this bit is zero.

LimitRec equals a bit of one if the medium changer device is to limit the extent of the error recovery that it will perform. Setting this bit will prevent the changer from performing any transfers on a cartridge that cannot be moved to a destination element or returned to its original source element. Rather than placing the cartridge in its original storage element, the import/export element, or in a drive, it will be left in the a medium transport element. The host software is then responsible for moving the cartridge from this element. Setting this bit also prevents the Rezero Unit command from unloading all drives. The default for this bit is zero.

ChgrEject equals a bit of one if the medium changer device is to eject a cartridge from an optical drive in response to a Move Medium or Exchange Medium command with the drive specified as the Source Element (or First Destination). If this bit is not set then the host software is responsible for ejecting the cartridge from the optical drive before the Move Medium or Exchange Medium command is issued. Setting this bit will also cause the Rezero Unit command to unload all drives before moving the changer device to its home position, unless the LmtErrRec bit is set as described above. If the medium transport element is not currently positioned at the drive, a signal will be sent to spin down the drive before positioning to it, thus improving overall cartridge exchange performance. The default for this bit is one.

WaitLoad equals a bit of one if the medium changer device is to wait for a Ready response from an optical drive in response to a Move Medium or Exchange Medium command with the drive specified as the Destination Element (or Second Destination). Command completion status is not returned to the host until the host is ready, or 35 seconds have elapsed. After 35 seconds, drive power is cycled in an attempt to reseat the cartridge. If this bit is not set then the host is responsible for waiting until the cartridge is spun up and ready. The default for this bit is zero.

IgnParity equals a bit of one if parity is to be ignored. This is non-standard for SCSI-2 but may be required for some initiators. The default for this bit is zero.

Park equals a bit of one if the Media Transport Element is to be moved to its park position on the next Rezero Unit command issued. This is required in preparation for shipment of the system. The default for this bit is zero.

SetDr1-6 and **SetDr7-12** equal a bit of one if an optical drive is to be set to the loaded or unloaded state in the medium changer device's non-volatile memory. Use SetDr1-6 for drives 1 to 6 and SetDr7-12 for drives 7 to 12. Setting these bits is generally unnecessary as non-volatile memory is updated automatically whenever a drive is loaded or unloaded. The Initialize Element Status command can also be used to update the empty/full status of the optical drives.

Loaded equals a bit of one if the corresponding optical drives are to be set to the loaded state or zero if they are to be set to the unloaded state. The SetDrive bit must also be set.

Drive Number is a code for the number of the drive to be set to the loaded or unloaded state. For drives 1 to 6, set SetDr1-6 above and use the values 1 to 6 in this field. For drives 7 to 12, set SetDr7-12 above and use the values 1 to 6 in this field (1 for drive 7, 2 for drive 8, etc.)

SetNBus equals a bit of one if the Number of Buses is to be set or a bit of zero if it is to remain unchanged.

Number of Buses specifies the number of SCSI buses for which the library system is to be configured. The following values may be used: 1, 2, or 4. If a value of 1 is used, the medium changer device and optical drives (up to 6 drives) are assumed to reside on a single SCSI bus. If a value of 2 is used, the medium changer and drives 1 - 3 are assumed to reside on one SCSI bus, and drives 4 - 6 are assumed to reside on a separate SCSI bus. If a value of 4 is used, the medium changer device is assumed to reside on

one SCSI bus, and the optical drives (up to 12 drives) are assumed to be distributed across three other SCSI buses based on the Mode Sense Drive Layout Page (see Section 4.8.8).

SetDrOpt equals a bit of one if any of the drive options in byte 6 are to be changed or a bit of zero if they are to remain unchanged.

FastSCSI equals a bit of one if all library system drives are to negotiate for synchronous transfer speeds up to 10MB/sec, or a bit of zero if library system drives are to limit transfer speeds to 5MB/sec. This option requres Rev. D or later drive cables, 2 or 4 bus library configuration, and the differential or redrive conversion kits. The default for this bit is zero.

DASDInq equals a bit of one if all library system drives are to identify themselves as Direct-Access Storage Devices (hard drives) in response to an Inquiry command, or a bit of zero if they are to identify themselves as optical drives. Some operating systems, such as UNIX, may require that the drives identify themselves as DASD devices. The default for this bit is zero.

FVerOnWr equals a bit of one if Force Verify on Write line on all library system drives is to be made active, or a bit of zero if it is to be made inactive. Note that all drives will have be powered down and then back up before any changes to this option take effect. This can be done by turning the library off and on again or via the Mode Select Drive Assignments Page (see Section 4.6.3). The default for this bit is zero.

WrCaEnab equals a bit of one if Write Cache Enable line on all library system drives is to be made active, or a bit of zero if it is to be made inactive. Note that all drives will have be powered down and then back up before any changes to this option take effect. This can be done by turning the library off and on again or via the Mode Select Drive Assignments Page (see Section 4.6.3). The default for this bit is one.

SetType equals a bit of one if the Event History Type is to be set or a bit of zero if it is to remain unchanged.

Event History Type specifies the type of event history to collect for diagnostic purposes (see Section 4.5.5). No history information will be collected for a value of zero. For a further description of this byte see Section 5. The default for this byte is BBh (187).

4.6.2 Vendor Unique Special Modes Page (21h)

The Mode Select Vendor Unique Special Modes Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (21h)					
1	Parameter Length (08h)							
2	LightOff	Reserved (0)					NoScanSE	NoScanDTE
3	SetOptions	Rsvd(0)	LogInfo	Reserved (0)			OpnExport	NoPwrCyc
4 - 9	Reserved (00h)							

LightOff equals a bit of one if the medium changer device is to leave its front panel ACTIVE light off for future SCSI bus activity. This is useful for element status polling. The ACTIVE light will remain enabled for any motor activity regardless of the setting of this bit. A bit of zero reenables the ACTIVE light for SCSI bus activity.

NoScanSE equals a bit of one if the storage elements are not to be scanned for subsequent Initialize Element Status commands.

NoScanDTE equals a bit of one if the data transfer elements (the drives) are not to be scanned for subsequent Initialize Element Status commands.

SetOptions equals a bit of one if any of the options in byte 3 are to be changed or a bit of zero if they are to remain unchanged.

LogInfo equals a bit of one if the Log Sense command is to return additional information in the Error Log Page (see Section 4.4.3). The SetOptions bit must also be set for this bit to be effective.

OpnExport equals a bit of one if the mailslot is to be opened when a cartridge is moved to it, or a bit of zero if the mailslot is to remain closed. The SetOptions bit must also be set for this bit to be effective. The default for this bit is zero.

NoPwrCyc equals a bit of one if the AC power to the optical drives is not to be cycled as part of the normal error recovery procedure or a bit of zero if the AC power is to be cycled in an attempt to reseat a badly seated cartridge. The SetOptions bit must also be set for this bit to be effective. Setting this bit reduces the ability of the library system to recover from drive load failures.

4.6.3 Drive Assignments Page (22h)

The Mode Select Drive Assignments Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (22h)					
1	Parameter Length (1Ah)							
2	Drive 1 On-Line							
3	Drive 1 SCSI ID							
4	Drive 2 On-Line							
5	Drive 2 SCSI ID							
6	Drive 3 On-Line							
7	Drive 3 SCSI ID							
8	Drive 4 On-Line							
9	Drive 4 SCSI ID							
10	Drive 5 On-Line							
11	Drive 5 SCSI ID							
12	Drive 6 On-Line							
13	Drive 6 SCSI ID							
14	Drive 7 On-Line							
15	Drive 7 SCSI ID							
16	Drive 8 On-Line							
17	Drive 8 SCSI ID							
18	Drive 9 On-Line							
19	Drive 9 SCSI ID							
20	Drive 10 On-Line							
21	Drive 10 SCSI ID							
22	Drive 11 On-Line							
23	Drive 11 SCSI ID							
24	Drive 12 On-Line							
25	Drive 12 SCSI ID							
26 - 27	Reserved (00h)							

Drive 1-12 On-Line are the on-line designators for the drives in the library system. If set to zero, the corresponding drive will be powered down and considered off-line. If set to a non-zero value, the corresponding drive will be powered up and considered on-line. This provides a means of taking malfunctioning drives off-line and reinstating them to on-line status, if so desired. If a drive is to be disconnected for replacement (hot-swapped), all drives on the same bus should be taken off-line. This can be done with one command. Any attempt to position to an off-line drive will be considered an error.

Drive 1-12 SCSI ID are the SCSI ID's of the optical drives in the library system. Changing these values changes the address of the drives on the SCSI bus on which they are located. The drives corresponding to the altered SCSI ID's will be automatically powered down and back up again to effect the change of address. SCSI ID's should be unique for drives on the same SCSI bus. The SCSI ID field is only used if the drive is on-line (powered up).

4.6.4 Front Panel Display Mode Page (23h)

The Mode Select Front Panel Display Mode Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (23h)					
1	Parameter Length (29h)							
2	Tone	LightOff	Reserved (0)				ClrKeys	DispMode
3 - 22	Line 1 Display Text							
23 - 42	Line 2 Display Text							

DispMode equals a bit of one to gain and maintain control of the library system front panel display or a bit of zero to release control.

ClrKeys equals a bit of one to clear all front panel key flags in preparation for subsequent key polling with the Mode Sense command. This bit is only effective if the DispMode bit is also set.

LightOff equals a bit of one if the front panel ACTIVE light is to be left in the off state for SCSI bus activity while the DispMode bit is set. This is useful for element status and key polling.

Tone equals a bit of one if a short alert tone is to be sounded within the library system. This bit is only effective if the DispMode bit is also set.

Line 1 Display Text is the ASCII representation of text to be displayed on the first line of the library system front panel display.

Line 2 Display Text is the ASCII representation of text to be displayed on the second line of the library system front panel display.

4.7 MODE SELECT (10) Command

The **Mode Select (10)** command provides a means for the initiator to select medium changer device parameters. It performs the same function as the Mode Select (6) command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (55h)							
1	Logical Unit Number (0)			PF (1)	Reserved (0)			SP
2 - 6	Reserved (00h)							
7 - 8	(MSB)			Parameter List Length				
								(LSB)
9	Reserved (00h)							

PF (Page Format) equals a bit of one indicating that parameters are structured as pages of related parameters.

SP (Save Pages) equals a bit of one if the target is to save changeable parameters in pages.

Parameter List Length specifies the length in bytes of the Mode Select (10) parameter list.

The Mode Select (10) parameter list consists of a 8 byte header followed by one or more of the medium changer device's supported pages. The header is shown below.

Mode Select (10) Mode Parameter Header

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	Mode Data Length (00h)							
2	Medium Type (00h)							
3	Device-Specific Parameter (00h)							
4 - 5	Reserved (00h)							
6 - 7	Block Descriptor Length (00h)							

See the Mode Select (6) command (Section 4.6) for information about supported mode pages.

4.8 MODE SENSE (6) Command

The **Mode Sense (6)** command provides a means for reporting medium changer device to an initiator.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Logical Unit Number (0)			Rsvd (0)	DBD (0)	Reserved (0)		
2	PC	Page Code						
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

DBD (Disable Block Descriptor) is ignored.

PC (Page Control) defines the type of parameter values to be returned. Normally, a value of zero is used to return the current values.

Page Code defines the parameter page(s) to be returned. A value of zero, 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, 24h, or 3Fh must be used. If a value of zero is used, no pages are returned. If a value of 1Dh, 1Eh, 1Fh, 20h, 21h, 22h, 23h, or 24h is used, the corresponding page as described below is returned. If a value of 3Fh is used, all supported pages are returned.

The **Allocation Length** specifies how many bytes of data are to be returned.

The Mode Sense (6) data block consists of a 4 byte header followed by one or more supported pages. The header is shown below followed by the supported pages.

Mode Sense (6) Mode Parameter Header

Bit Byte	7	6	5	4	3	2	1	0
0	Mode Data Length							
1	Medium Type (00h)							
2	Device-Specific Parameter (00h)							
3	Block Descriptor Length (00h)							

Mode Data Length is the length in bytes of the remainder of the Mode Sense (6) return data.

4.8.1 Element Address Assignment Page (1Dh)

The Mode Sense Element Address Assignment Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Rsvd (0)	Page Code (1Dh)					
1	Parameter Length (12h)							
2 - 3	(MSB)	First Medium Transport Element Address (8001)						
								(LSB)
4 - 5	(MSB)	Number of Medium Transport Elements (2)						
								(LSB)
6 - 7	(MSB)	First Storage Element Address (1)						
								(LSB)
8 - 9	(MSB)	Number of Storage Elements (500)						
								(LSB)
10 - 11	(MSB)	First Import/Export Element Address (4001)						
								(LSB)
12 - 13	(MSB)	Number of Import/Export Elements (1)						
								(LSB)
14 - 15	(MSB)	First Data Transfer Address (6001)						
								(LSB)
16 - 17	(MSB)	Number of Data Transfer Elements (1-12)						
								(LSB)
18 - 19	Reserved (00h)							

4.8.2 Transport Geometry Parameters Page (1Eh)

The Mode Sense Transport Geometry Parameters Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS(0)	Rsvd (0)	Page Code (1Eh)					
1	Parameter Length (04h)							
2	Reserved (0)							Rotate (1)
3	Member Number in Transport Element Set (00h)							
4	Reserved (0)							Rotate (1)
5	Member Number in Transport Element Set (01h)							

Where **Rotate** equals a bit of one indicating that the medium transport element supports media rotation for handling double-sided media.

4.8.3 Device Capabilities Page (1Fh)

The Mode Sense Device Capabilities Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS(0)	Rsvd (0)	Page Code (1Fh)					
1	Parameter Length (12h)							
2	Reserved (0)				StorD(1)	StorI(1)	StorS(1)	StorM(0)
3	Reserved (00h)							
4	Reserved (0)				M → D(1)	M → I(0)	M → S(1)	M → M(0)
5	Reserved (0)				S → D(1)	S → I(1)	S → S(1)	S → M(1)
6	Reserved (0)				I → D(1)	I → I(0)	I → S(1)	I → M(0)
7	Reserved (0)				D → D(1)	D → I(1)	D → S(1)	D → M(1)
8 - 11	Reserved (00h)							
12	Reserved (0)				M ↔ D(0)	M ↔ I(0)	M ↔ S(0)	M ↔ M(0)
13	Reserved (0)				S ↔ D(1)	S ↔ I(1)	S ↔ S(1)	S ↔ M(0)
14	Reserved (0)				I ↔ D(1)	I ↔ I(0)	I ↔ S(1)	I ↔ M(0)
15	Reserved (0)				D ↔ D(1)	D ↔ I(1)	D ↔ S(1)	D ↔ M(0)
16 - 19	Reserved (00h)							

Where **D** is a data transfer element
I is the Import / Export Element
S is a storage element
M is the medium transport element
Stor indicates storage capability
→ indicates Move Medium capability (first element type is for Source, second element type is for Destination)
↔ indicates Exchange Medium capability (first element type is for Source and Second Destination, second element type is for First Destination)

and the available capabilities are as indicated (a bit of one means yes in all cases and a bit of zero means no in at least some cases).

4.8.4 Vendor Unique Mode Parameters Page (20h)

The Mode Sense Vendor Unique Mode Parameters Page is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (20h)					
1	Parameter Length (08h)							
2	ReportRec	SlowScans	LimitRec	ChgrEject	Rsvd (0)	WaitLoad	IgnParity	Park
3	Model Identification (7)			Reserved (0)				
4	Reserved (0)					Number of Buses		
5	Internal Temperature							
6	Reserved (0)				FastSCSI	DASDInq	FVerOnWr	WrCaEnab
7	Reserved (00h)							
8	Reserved (0)					NoVTag(1)	CanClose(1)	CanOpen(1)
9	Event History Type							

ReportRec, SlowScans, LimitRec, ChgrEject, WaitLoad, IgnParity, Park, Number of Buses, FastSCSI, DASDInq, FVerOnWr, WrCaEnab, and **Event History Type** are as set by the Mode Select command.

Model Identification equals 7 for the M500.

Internal Temperature equals the internal library system temperature at the rear of the drives. The value is in degrees Celsius.

CanOpen equals a bit of one indicating that the library supports mailslot opening via the Open Close Mailslot command. This bit can be used to distinguish this capability of the M500 from other older Plasmon libraries which do not support this feature.

CanClose equals a bit of one indicating that the library supports mailslot closure via the Open Close Mailslot command. This bit can be used to distinguish this capability of the M500 from other M-Series and older Plasmon libraries which do not support this feature.

NoVTag equals a bit of one indicating that the library does not support volume tags. This bit can be used to distinguish this inability of the M500 from other M-Series and older Plasmon libraries which do support volume tags.

4.8.5 Vendor Unique Special Modes Page (21h)

The Mode Sense Vendor Unique Special Modes Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (21h)					
1	Parameter Length (08h)							
2	LightOff	Reserved (0)					NoScanSE	NoScanDTE
3	Reserved (0)		LogInfo	Reserved (0)			OpnExport	NoPwrCyc
4 - 9	Reserved (00h)							

LightOff, NoScanSE, NoScanDTE, LogInfo, OpnExport, and **NoPwrCyc** are as set by the Mode Select command.

4.8.6 Drive Assignments Page (22h)

The Mode Sense Drive Assignments Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (1)	Rsvd (0)	Page Code (22h)					
1	Parameter Length (1Ah)							
2	Drive 1 Type							
3	Drive 1 SCSI ID							
4	Drive 2 Type							
5	Drive 2 SCSI ID							
6	Drive 3 Type							
7	Drive 3 SCSI ID							
8	Drive 4 Type							
9	Drive 4 SCSI ID							
10	Drive 5 Type							
11	Drive 5 SCSI ID							
12	Drive 6 Type							
13	Drive 6 SCSI ID							
14	Drive 7 Type							

Bit Byte	7	6	5	4	3	2	1	0
15	Drive 7 SCSI ID							
16	Drive 8 Type							
17	Drive 8 SCSI ID							
18	Drive 9 Type							
19	Drive 9 SCSI ID							
20	Drive 10 Type							
21	Drive 10 SCSI ID							
22	Drive 11 Type							
23	Drive 11 SCSI ID							
24	Drive 12 Type							
25	Drive 12 SCSI ID							
26 - 27	Reserved (00h)							

Drive 1-12 Type are the drive type designators for the optical drives in the library system. If a drive is off-line (powered-off), it's Drive Type will be zero.

Drive 1-12 SCSI ID are the SCSI ID's of the optical drives in the library system. If a drive is off-line (powered down), its SCSI ID will not be used until the drive is brought back on-line (powered up).

4.8.7 Front Panel Display Mode Page (23h)

The Mode Sense Front Panel Display Mode Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Rsvd (0)	Page Code (23h)					
1	Parameter Length (29h)							
2	Rsvd (0)	LightOff	Rsvd (0)	Key Pressed			Rsvd (0)	DispMode
3 - 42	Reserved (00h)							

LightOff and **DispMode** are as set by the Mode Select command.

Key Pressed equals zero if no key was pressed or one of the following:

1 First (left-most) key was pressed
2 Second key was pressed
3 Third key was pressed
4 Fourth (right-most) key was pressed

The Key Pressed field is cleared every time that this page is returned so that each Mode Sense command returns key presses since the last Mode Sense command was issued.

4.8.8 Drive Layout Page (24h)

The Mode Sense Drive Layout Page is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	Rsvd (0)	Page Code (24h)					
1	Parameter Length (19h)							
2	Drive 1 Tower (2)				Drive 1 Vertical Position (2)			

Bit Byte	7	6	5	4	3	2	1	0
3	Drive 1 SCSI Bus (1 for single bus, 1 for dual bus, or 2 for quad bus)							
4	Drive 2 Tower (2)				Drive 2 Vertical Position (1)			
5	Drive 2 SCSI Bus (1 for single bus, 1 for dual bus, or 2 for quad bus)							
6	Drive 3 Tower (3)				Drive 3 Vertical Position (2)			
7	Drive 3 SCSI Bus (1 for single bus, 1 for dual bus, or 3 for quad bus)							
8	Drive 4 Tower (3)				Drive 4 Vertical Position (1)			
9	Drive 4 SCSI Bus (1 for single bus, 2 for dual bus, or 3 for quad bus)							
10	Drive 5 Tower (4)				Drive 5 Vertical Position (2)			
11	Drive 5 SCSI Bus (1 for single bus, 2 for dual bus, or 4 for quad bus)							
12	Drive 6 Tower (4)				Drive 6 Vertical Position (1)			
13	Drive 6 SCSI Bus (1 for single bus, 2 for dual bus, or 4 for quad bus)							
14	Drive 7 Tower (2)				Drive 7 Vertical Position (3)			
15	Drive 7 SCSI Bus (0=N/A for single bus, 0=N/A for dual bus, or 2 for quad bus)							
16	Drive 8 Tower (3)				Drive 8 Vertical Position (3)			
17	Drive 8 SCSI Bus (0=N/A for single bus, 0=N/A for dual bus, or 3 for quad bus)							
18	Drive 9 Tower (4)				Drive 9 Vertical Position (3)			
19	Drive 9 SCSI Bus (0=N/A for single bus, 0=N/A for dual bus, or 4 for quad bus)							
20	Drive 10 Tower (2)				Drive 10 Vertical Position (4)			
21	Drive 10 SCSI Bus (0=N/A for single bus, 0=N/A for dual bus, or 2 for quad bus)							
22	Drive 11 Tower (3)				Drive 11 Vertical Position (4)			
23	Drive 11 SCSI Bus (0=N/A for single bus, 0=N/A for dual bus, or 3 for quad bus)							
24	Drive 12 Tower (4)				Drive 12 Vertical Position (4)			
25	Drive 12 SCSI Bus (0=N/A for single bus, 0=N/A for dual bus, or 4 for quad bus)							
26	Reserved (00h)							

Drive 1-12 Tower are the library system tower numbers (from 1 to 5) for the drives in the library system. The drives occupy the center three towers in the library system. The first library system tower contains the first storage element, SE1.

Drive 1-12 Vertical Position are vertical positions of the corresponding drives in each tower with position 1 corresponding to the lowest drive position within the tower.

Drive 1-12 SCSI Bus are the internal library SCSI bus numbers for the drives in the library system. Note that this number depends upon whether the library system is configured for one, two, or four internal SCSI buses. Refer to the Number of Buses field in the Mode Select Vendor Unique Mode Parameters Page (Section 4.6.1).

4.9 MODE SENSE (10) Command

The **Mode Sense (10)** command provides a means for reporting medium changer device to an initiator. It performs the same function as the Mode Sense (6) command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Ah)							
1	Logical Unit Number (0)			Rsvd (0)	DBD (0)	Reserved (0)		
2	PC		Page Code					
3 - 6	Reserved (00h)							
7 - 8	(MSB)		Allocation Length					
								(LSB)
9	Reserved (00h)							

DBD (Disable Block Descriptor) is ignored.

PC (Page Control) defines the type of parameter values to be returned. Normally, a value of zero is used to return the current values.

Page Code defines the parameter page(s) to be returned.

The **Allocation Length** specifies how many bytes of data are to be returned.

The Mode Sense (10) data block consists of a 8 byte header followed by one or more supported pages. The header is shown below.

Mode Sense (10) Mode Parameter Header

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB)			Mode Data Length				
								(LSB)
2	Medium Type (00h)							
3	Device-Specific Parameter (00h)							
4 - 5	Reserved (00h)							
6 - 7	Block Descriptor Length (00h)							

Mode Data Length is the length in bytes of the remainder of the Mode Sense (10) return data.

See the Mose Sense (6) command (Section 4.8) for information about supported mode pages.

4.10 MOVE MEDIUM Command

The **Move Medium** command instructs the medium changer device move a unit of media from a source element to a destination element.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 3	(MSB)			Transport Element Address				
								(LSB)
4 - 5	(MSB)			Source Element Address				
								(LSB)
6 - 7	(MSB)			Destination Address				
								(LSB)
8 - 9	Reserved (00h)							
10	Reserved (0)							Invert
11	Reserved (00h)							

Transport Element Address specifies the medium transport element. A value of zero should normally be used. This will move the cartridge using the first medium transport element. The address of a specific medium transport element may also be used.

Source Element Address specifies the source element.

Destination Address specifies the destination element.

Invert specifies the medium should be inverted. If the Invert bit is one, the media is inverted ("flipped") prior to being deposited into the destination element.

Note that since the first medium transport element cannot reach the import/export element in the inverted position, and the second medium transport element cannot reach the import/export element not in the inverted position, not all combinations involving the import/export element will be permitted.

4.11 OPEN CLOSE MAILSLOT Command

The **Open Close Mailslot** command instructs the medium changer device to open the import/export slot (the mailslot) thus enabling cartridge insertion or removal, or to close the slot thus disabling cartridge insertion and removal. This command has no effect if the changer has been placed in the Prevent state by the Prevent Allow Medium Removal command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (0Ch)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 3	Reserved (00h)							
4	Reserved (0)							Open
5	Reserved (00h)							

Open equals a bit of one if the medium changer device is to open rather than close the mailslot.

4.12 POSITION TO ELEMENT Command

The **Position to Element** command positions one of the two medium transport elements (MTE's) in front of the specified Destination Element so that no further movement of the MTE is necessary to execute a subsequent Move Medium or Exchange Medium command. Note that the two medium transport elements are connected so positioning one will also move the other. If the ChgrEject bit in the Mode Select command is not set, this command *must be used* to ensure that an MTE is positioned in front of an Optical Disk Drive before an eject command can be issued to that drive.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 3	(MSB)			Transport Element Address				
								(LSB)
4 - 5	(MSB)			Destination Element Address				
								(LSB)
6 - 7	Reserved (00h)							
8	Reserved (0)							Invert
9	Reserved (00h)							

Transport Element Address specifies the medium transport element to be positioned. A value of zero should normally be used. This will position the first medium transport element in front the destination element specified. The address of a specific medium transport element may also be used.

Destination Address specifies the destination element to position in front of.

Invert equals a bit of one if the medium transport element is to be inverted ("flipped") before it is positioned at the destination element.

Note that since the first medium transport element cannot reach the import/export element in the inverted position, and the second medium transport element cannot reach the import/export element not in the inverted position, not all combinations involving the import/export element will be permitted.

4.13 PREVENT ALLOW MEDIUM REMOVAL Command

The **Prevent Allow Medium Removal** command instructs the medium changer device to either inhibit or permit opening of the import/export slot (the mailslot) for cartridge insertion or removal. If left in the Allow state, the slot can be opened by a button on the front panel or by using the Open Close Mailslot command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 3	Reserved (0)							
4	Reserved (0)							Prevent
5	Reserved (00h)							

Prevent equals a bit of one if opening of the mailslot is to be inhibited, or a bit of zero if the opening of the mailslot is to be allowed

4.14 READ ELEMENT STATUS Command

The **Read Element Status** command requests the medium changer device report the status of its internal elements to the initiator.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Logical Unit Number (0)			VolTag (0)	Element Type Code			
2 - 3	(MSB)			Starting Element Address				
								(LSB)
4 - 5	(MSB)			Number of Elements				
								(LSB)
6	Reserved (00h)							
7 - 9	(MSB)			Allocation Length				
								(LSB)
10 - 11	Reserved (00h)							

VolTag (Volume Tag) equals bit of zero since the medium changer device does not support volume tags.

Element Type Code specifies an element type as follows:

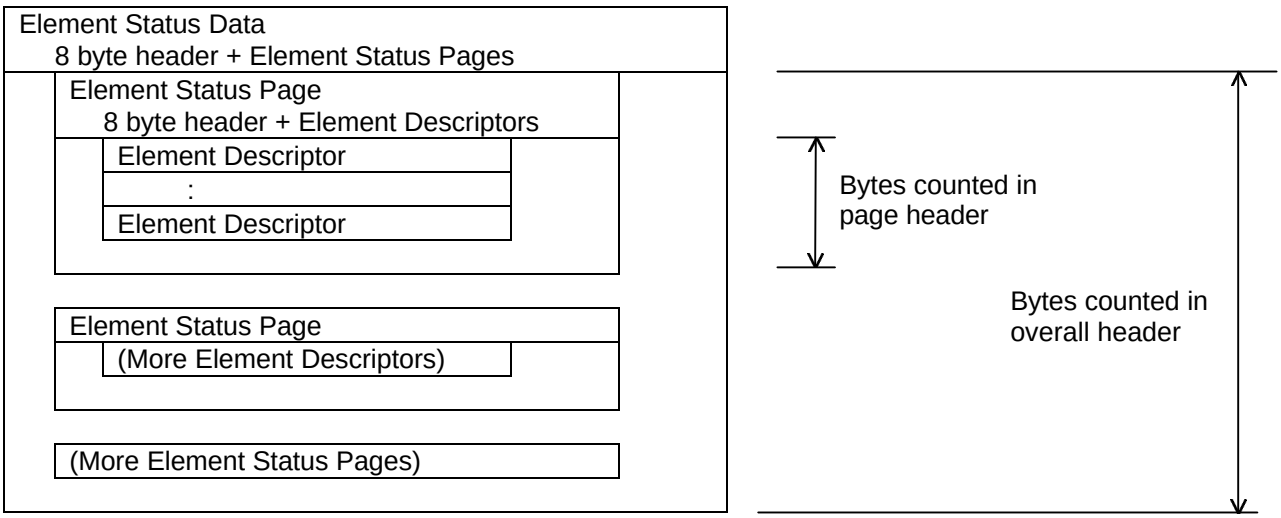
- **0** All element types
- **1** Medium transport element
- **2** Storage element
- **3** Import/export element
- **4** Data transfer element

Starting Element Address specifies the minimum element address to report. Only elements with an element type permitted by the Element Type Code and the Starting Element Address are reported.

Number of Elements specifies the maximum number of element descriptor tags to be reported by the medium changer device for this command. The value specified by this field is not the range of element addresses to be considered for reporting but rather the number of elements to report.

Allocation Length specifies the length of the Element Status Data.

The structure of the **Element Status Data** returned is as follows:



The element status data header format is shown following.

Element Status Data

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB)	First Element Address Reported						
								(LSB)
2 - 3	(MSB)	Number of Elements Reported						
								(LSB)
4	Reserved (00h)							
5 - 7	(MSB)	Byte Count of Report Available (all pages, x - 7)						
								(LSB)
8 - x	Element Status Page(s)							

The element status page header format is shown following.

Element Status Page Header

Bit / Byte	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PVolTag (0)	AVolTag (0)	Reserved (00h)					
2 - 3	(MSB)	Element Descriptor Length (10h)						
								(LSB)
4	Reserved (00h)							
5 - 7	(MSB)	Byte Count of Descriptor Data Available (this page, y - 7)						
								(LSB)
8 - y	Element Descriptor(s)							

The format of the element descriptors follows. Descriptors are returned in element address order.

4.14.1 Medium Transport Element Descriptor

The medium transport element descriptor is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB)	Element Address						
								(LSB)
2	Reserved (0)					Except	Rsvd (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved (00h)							
9	Svalid	Invert	Reserved (0)					
10 - 11	(MSB)	Source Storage Element Address						
								(LSB)
12 - 15	Reserved (00h)							

Except equals a bit of one if the element is in an abnormal state. In this case, additional information is given in the Additional Sense Code and in the Additional Sense Code Qualifier fields.

Full equals a bit of one if the element contains a unit of media.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to a non-recoverable error condition. These error codes are listed in Section 6.1.

SValid (Storage Element Valid) equals bit of one if Source Storage Element Address and Invert bit are valid.

Invert equals a bit of one if the unit of media now in this element was inverted by Move Medium operation since it was last in the Source Storage Element Address.

Source Storage Element Address provides the address of the last storage element this unit of media was moved from.

4.14.2 Storage Element Descriptor

The storage element descriptor is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB)			Element Address				
								(LSB)
2	Reserved (0)				Access	Except	Rsvd (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved (00h)							
9	Svalid	Invert		Reserved (0)				
10 - 11	(MSB)			Source Storage Element Address				
								(LSB)
12 - 15	Reserved (00h)							

Access equals a bit of one if element access by the medium transport element is allowed.

Other fields are the same as for the medium transport element descriptor.

4.14.3 Import / Export Element Descriptor

The import/export element descriptor is as follows.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB)			Element Address				
								(LSB)
2	Reserved (0)		InEnab(1)	ExEnab(1)	Access	Except	ImpExp	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved (00h)							
9	Svalid	Invert		Reserved (0)				
10 - 11	(MSB)			Source Storage Element Address				
								(LSB)
12 - 15	Reserved (00h)							

InEnab (Import Enable) equals a bit of one indicating that the import/export element supports movement of media into the scope of the medium changer device.

ExEnab (Export Enable) equals a bit of one indicating that the import/export element supports movement of media out of the scope of the medium changer device.

Access equals a bit of one if access to the import/export element by the medium transport element is allowed (the mailslot is closed) or a bit of zero if access is not allowed (the mailslot is open).

ImpExp equals a bit of one if the unit of media in the import/export element was placed there by an operator, or a bit of zero if the unit of media was placed there by the medium transport element.

Other fields are the same as for the medium transport element descriptor.

4.14.4 Data Transfer Element Descriptor

The data transfer element descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB)			Element Address				
								(LSB)
2	Reserved (0)				Access	Except	Rsvd (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Rsvd (0)	IDValid	LUValid	Rsvd (0)	Logical Unit Number (0)		
7	SCSI Bus Address							
8	Reserved (00h)							
9	Svalid	Invert	Reserved (0)					
10 - 11	(MSB)			Source Storage Element Address				
								(LSB)
12 - 15	Reserved (00h)							

Access bit of one indicates access to the data transfer element by the medium transport element is allowed. Access may require that a SCSI Start Stop Unit command be sent to the corresponding optical drive to effect an eject.

Not Bus equals a bit of one if the data transfer element (the drive) is on a different SCSI bus than the medium changer device *internal to the library system*, or a bit of zero if it is on the same SCSI bus as the medium changer device *internal to the library system*. External jumpers between the buses are not taken into account.

LUValid equals a bit of one if the Logical Unit Number field contains valid information.

IDValid equals a bit of one if the SCSI Bus Address field contains valid information.

Logical Unit Number is always equal to zero.

SCSI Bus Address is the SCSI ID of the corresponding optical drive.

Other fields are the same as for the medium transport element descriptor.

4.15 RELEASE Command

The **Release** command is used to release a previously reserved medium changer device or previously reserved elements within it.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Logical Unit Number (0)			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3 - 5	Reserved (00h)							

Element equals bit of one if a specific set of elements is to be released or a bit of zero if the entire medium changer device is to be released.

3rdPty equals a bit of one if a reservation made using the 3rdPty option of the Reserve command is to be released.

Third Party Device ID is the SCSI ID of the initiator for whom the reservation was made if the 3rdPty bit is set.

Reservation Identification is a code byte used to identify a specific element reservation to be released.

4.16 REQUEST SENSE Command

The **Request Sense** command requests that the medium changer device send Sense Data to the initiator.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

The Sense Data will be valid for a CHECK CONDITION status returned on the prior command. The Sense Data will be preserved by the medium changer device until retrieved by the Request Sense command or until receipt of any other command.

The Request Sense command shall return a CHECK CONDITION status only to report fatal errors for the Request Sense command. For example:

1) The medium changer device detects a non-zero reserve bit in the CDB.
2) An unrecoverable parity error occurred on the DATA BUS.
3) An medium changer device malfunction prevents return of the sense data.

Any nonfatal error occurring during the execution of the Request Sense command shall return the sense data with GOOD status.

The Sense Data Format is available as shown on the following page for an Allocation Length of 36.

Sense Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Valid (0)	Error Code (70h)						
1	Reserved (00h)							
2	Reserved (0)				Sense Key			
3 - 6	Reserved (00h)							
7	Additional Sense Length (1Ch)							
8 - 11	Reserved (00h)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved (00h)							
15	SKSV	Sense-Key Specific						
16 - 17								
18 - 35	Additional Sense Bytes							

Sense Key is described below.

Additional Sense Length equals 1Ch.

Additional Sense Code and **Additional Sense Code Qualifier** indicate detailed information related to an error or exception condition. These error codes are listed in Section 6.1.

SKSV (Sense-Key Specific Valid) equals a bit of one if the Sense Key Specific field contains valid information.

Sense-Key Specific contains information that is specific to the type of error returned.

Additional Sense Bytes contain additional information about the error returned.

The following Sense Key values are returned by the medium changer device.

Sense Key Descriptions

Sense Key	Description
0	NO SENSE. Indicates that there is no specific sense key information to be reported. This is the case for a successful command.
1	RECOVERED ERROR. Indicates that the last command completed successfully with some recovery action performed. Information about the first hardware error encountered is available in the data fields above.
2	NOT READY. Indicates that the medium changer device cannot be accessed.
4	HARDWARE ERROR. Indicates that the medium changer device encountered a non-recoverable hardware failure while performing the command or during self test.
5	ILLEGAL REQUEST. Indicates an illegal parameter in the CDB or in additional parameters supplied as data.
6	UNIT ATTENTION. Indicates that Mode parameters have been changed or the target has been reset.

If the Sense Key is equal to 5 (Illegal Request) and the SKSV is set to one, the Sense-Key Specific fields contain the following information.

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved (0)		BPV	Bit Pointer		
16 - 17	(MSB)	Field Pointer						
								(LSB)

C/D (Command/Data) equals a bit of one if the illegal parameter is in the command descriptor block or a bit of zero if the illegal parameter is in the data parameters sent during the DATA OUT phase.

BPV (Bit Pointer Valid) equals a bit of one if the value in the Bit Pointer field is valid.

Bit Pointer indicates the left-most (most-significant) bit of the field which is in error.

Field Pointer indicates the byte of the command descriptor block or of the parameter data which in error. When a multiple-byte field is in error, this field contains the first (most-significant) byte of the field which is in error.

If the Sense Key is equal to 4 (Hardware Error) or 1 (Recovered Error) and the SKSV is set to one, the Sense-Key Specific fields contain the following information.

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	Reserved (0)						
16 - 17	(MSB)	Actual Retry Count						
								(LSB)

Actual Retry Count equals the number of retries used in attempting to recover from the error.

Also, for these types of errors, the **Additional Sense Bytes** field contains the following information.

Bit Byte	7	6	5	4	3	2	1	0
18	ChgrReady	Restored	Completed	AllReturned	MTE1Full	MTE2Full	Rsvd (0)	FailSecond
19	InfoValid	(First) Source Cartridge Location			(First) Containing Element Number			Inverted
20 - 21	(MSB)	(First) Source Element Address						
								(LSB)
22 - 23	(MSB)	(First) Destination Element Address						
								(LSB)
24	Info2Valid	Second Source Cartridge Location			Second Containing Element Number			Inverted2
25 - 26	(MSB)	Second Source Element Address						
								(LSB)
27 - 28	(MSB)	Second Destination Element Address						
								(LSB)
29	Medium Transport Element Number							
30 - 31	(MSB)	Lift Position Element Address						
								(LSB)
32 - 33	Additional Information							
34 - 35	Reserved (00h)							

ChgrReady equals a bit of one if the medium changer device is ready to accept new cartridge movement commands or a bit of zero if the medium changer device is jammed and a Rezero Unit command is required to reinitialize the unit.

Restored equals a bit of one if all cartridges being moved have been returned to their source elements and the medium changer device has been restored to the state in which it was in before the last command was issued.

Completed equals a bit of one if cartridges have been moved and the last command completed successfully.

AllReturned equals a bit of one if all cartridges have been returned to their last storage element locations.

MTE1Full equals a bit of one if the first medium transport element (address 8001) is full.

MTE2Full equals a bit of one if the second medium transport element (address 8002) is full.

FailSecond equals a bit of one if the failure occurred on the second move of an Exchange Medium command (from the First Destination Element to the Second Destination Element) or a bit of zero if the failure occurred on the first move (from the Source Element to the First Destination Element). The second move is actually executed first.

InfoValid equals a bit of one if bytes 18 to 23 contain valid information about the last cartridge movement command, or the first move of an Exchange Medium command (Source to First Destination Element).

Info2Valid equals a bit of one if bytes 24 to 28 contain valid information about the second move of an Exchange Medium command (First Destination Element to Second Destination Element).

(First) Source Cartridge Location and **Second Source Cartridge Location** contain values indicating the final location of the cartridges in the first and second source elements, respectively. (The second source element is the First Destination Element of an Exchange Medium command.) These values are as follows:

- **1** Cartridge is in source element
- **2** Cartridge is in medium transport element (if not the source or destination element) where the MTE is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for MTE1 or 2 for MTE2)
- **3** Cartridge is in destination element
- **4** Cartridge is in its last occupied storage element (if not the source or destination element)
- **5** Cartridge has been lost
- **6** Cartridge is in import/export element (if not the source or destination element)
- **7** Cartridge is in data transfer element 1 to 6 (if not the source or destination element) where the DTE is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for DTE1, 2 for DTE2, etc.)
- **0** Cartridge is in data transfer element 7 to 12 (if not the source or destination element) where the DTE is specified by the (First) Containing Element Number or Second Containing Element Number fields (1 for DTE7, 2 for DTE8, etc.)

(First) Containing Element Number and **Second Containing Element Number** are the numbers of the elements containing the cartridges originally in the first and second source elements, respectively, if the corresponding Source Cartridge Location fields contain the numbers 2 or 7, starting with 1 for MTE1, and 1 for DTE1 (optical drive 1) or DTE7 (optical drive 7).

Inverted and **Inverted2** equal bits of one if the cartridges originally in the first and second source elements, respectively, are now inverted from their original states.

(First) Source Element and **(First) Destination Element** are the addresses of Source and Destination Elements of the last cartridge movement command, or the Source and First Destination Elements of the last Exchange Medium command.

Second Source Element and **Second Destination Element** are the addresses of First and Second Destination Elements of the last Exchange Medium command.

Medium Transport Element Number is the number of the medium transport element (1 or 2) in use when the error occurred.

Lift Position Element Address is the address of the element at which the medium transport element specified by the medium transport element Number field was positioned when the error occurred.

Additional Information contains such information as the value of ASC and ASCQ received from the drive in the event of an eject failure when the ChgrEject mode of operation is enabled or the drive not becoming ready when the WaitLoad mode of operation is enabled (see Section 4.6.1).

4.17 RESERVE Command

The **Reserve** command is used to reserve the medium changer device or specific elements within it.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	Logical Unit Number (0)			3rdPty	Third Party Device ID			Element
2	Reservation Identification							
3 - 4	(MSB)			Element List Length				
								(LSB)
5	Reserved (00h)							

Element equals bit of one if specific elements are to be reserved or a bit of zero if the entire medium changer device is to be reserved.

3rdPty equals a bit of one if the reservation is to be made for the initiator specified by the Third Party Device ID field or a bit of zero if the reservation is to be made for the initiator issuing the command.

Third Party Device ID is the SCSI ID of the initiator for whom the reservation is to be made if the 3rdPty bit is set.

Reservation Identification provides a means for the initiator to to identify each element reservation with a specified code byte. It is used in the Release command to specify which reservation is to be released and in a superseding Reserve command to specify which reservation is to be superseded

Element List Length specifies the length in bytes of the Reserve element list.

The Reserve element list consists of zero or more of the following reserve element list descriptors.

4.17.1 Reserve Element List Descriptor

The Reserve Element List Descriptor is as follows.

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	Reserved (00h)							
2 - 3	(MSB)			Number of Elements				
								(LSB)
4 - 5	(MSB)			Element Address				
								(LSB)

Element Address is the beginning element address to start assigning reservations for.

Number of Elements is the number of elements to reserve or zero if elements are to be assigned beginning at the specified element address through the last element address on the unit.

4.18 REZERO UNIT Command

The **Rezero Unit** command reinitializes the medium changer device. Then, depending upon the ChgrEjects and LmtErrRec bits in the Mode Select Vendor Unique Mode Parameter Page (see Section 4.6.1), cartridges in the medium transport element and loaded data transfer elements (optical drives) may be put back in the storage elements from which they originally came. The medium changer device will then go to its home position. If the Park bit is set by the Mode Select command, the medium transport element will move to its park position and *no other SCSI commands will be accepted*. For the Park option to be effective, all disk cartridges must be first removed from the library system as the intent is to prepare the system for shipment.

Note: unless the LmtErrRec bit is set or the ChgrEjects bit is reset in the Mode Select Vendor Unique Mode Parameter Page, the Rezero Unit command will unload all drives.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 5	Reserved (00h)							

4.19 SEND DIAGNOSTIC Command

The **Send Diagnostic** command instructs the medium changer device to perform self-diagnostic tests. Currently, this invokes a checksum comparison on the library system firmware.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	Logical Unit Number (0)			PF (0)	Rsvd (0)	Selftst (1)	DevOfl (0)	UnitOfl (0)
2	Reserved (0)							
3 - 4	(MSB)			Parameter List Length (00h)				
								(LSB)
5	Reserved (00h)							

PF (Page Format) is ignored.

Sefltst (Self Test) equals a bit of one indicating default self-test.

Dev0fL (Device Off-line) and **Unit0fL** (Unit Off-line) both equal bits of zero indicating no vendor specific diagnostic that may be visible to other initiators.

Parameter List Length equals zero.

The Send Diagnostic command returns status of GOOD if no errors occur, else a CHECK CONDITION will be set. Send a Request Sense command to obtain information about the problem.

4.20 TEST UNIT READY Command

The **Test Unit Ready** command provides a means of checking medium changer device ready status.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (00h)							
1	Logical Unit Number (0)			Reserved (0)				
2 - 5	Reserved (00h)							

If the medium changer device is able to accept a medium access command without returning a CHECK CONDITION status, the Test Unit Ready command will return a GOOD status.

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5. Event History Type and Event Description

The Event History Type byte of the Vendor Unique Mode Parameters Page (Section 4.6.1) determines which values are recorded in the Event List (Section 4.5.5). The format of the Event History Type byte is as follows.

Event History Type (Vendor Unique Mode Parameters Page)

Bit Byte	7	6	5	4	3	2	1	0
9	CmdFilter	SCSI Activity		Terse	Src/Dst	MTE	DrivePwr	Init/Rec

CmdFilter equals a bit of one if only SCSI commands which effect a change to the library are to be recorded in the Event List. If this bit is set, all Test Unit Ready, Request Sense, Inquiry, Mode Sense, Log Sense, and Read Element Status commands will not be recorded in the Event List. If this bit is zero, all SCSI commands received will be recorded, subject to the SCSI Activity field and the Terse bit.

SCSI Activity equals one of the following:

- **0** No recording of SCSI activity
- **1** Record first byte of command only (byte 0)
- **2** Record all command bytes sent and all data bytes received
- **3** Record first byte of command byte and all message and status bytes

SCSI activity bytes which are recorded in the Event List are preceeded in the list by one or more of the following bytes, unless the Terse bit is set.

Cnh	changer is selected by host; n is host SCSI ID (logged for SCSI Activity cases 1,2,3 above). This byte is logged even if the Terse bit is set
Dnh	Drive is selected by changer, or drive has reselected changer; n is drive SCSI ID (logged for SCSI Activity cases 1,2,3 above). This byte is logged even if the Terse bit is set
E0h	Message byte received from host in target mode (case 3 above)
E1h	Non-zero message byte sent to host in target mode (case 3 above)
E2h	Command byte(s) received from host in target mode (cases 1,2,3 above)
E3h	Data bytes received from host in target mode (case 2 above)
E4h	Non-zero status byte sent to host in target mode (case 3 above)
E8h	Non-zero message byte sent to drive in initiator mode (case 3 above)
E9h	Message byte received from drive in initiator mode (case 3 above)
EAh	Command byte(s) sent to drive in initiator mode (cases 1,2,3 above)
EBh	Data bytes received from drive in initiator mode (case 2 above)
ECh	Status byte received from drive in initiator mode (case 3 above)
F0h	Non-zero ASC/ASCQ returned to host (cases 1,2,3 above). This byte is logged even if the Terse bit is set
F1h	Non-zero ASC/ASCQ received from drive (cases 1,2,3 above). This byte is logged even if the Terse bit is set

Terse equals a bit of zero if flags bytes (above) indicating the type of SCSI activity are to be recorded, or a bit of one if no flag bytes (other than those indicated) are to be recorded.

Src/Dst equals a bit of one if source and destination element addresses for Position to Element, Move Medium, and Exchange Medium commands are to be recorded, or a bit of zero if no source and destination element addresses are to be recorded.

For clarity and to save space in the Event List, drives are logged as D1h, D2h, etc.; MTE's are logged as E1h and E2h; the Import/Export is logged as EEh; slot numbers less than 200 are logged as one byte; and slot numbers greater than or equal to 200 are logged as two - the first (MSB) being OR'd with FCh.

For example, the following is the Event List of an Exchange Medium from SE1 to D1 to SE255:

C7 (E2) A6 (...) 01 D1 FC FF

MTE equals a bit of one if the medium transport element used for Position to Element, Move Medium, and Exchange Medium commands is to be recorded, or a bit of zero if the medium transport element is not to be recorded

The MTE used is logged as E1h or E2h (for MTE1 or MTE2, respectively). If the default address of zero is specified for the Exchange Medium command, then E3h is logged if the exchange begins with MTE1 or E4h is logged if the exchange begins with MTE2. The MTE used is logged after the source and destination element bytes if the Src/Dst bit is set.

DrivePwr equals a bit of one if flag bytes for drive power cycling are to be recorded, or a bit of zero if no flag bytes for drive power cycling are to be recorded.

The following flag bytes are recorded for drive power cycling.

F2h	Drive power cycled because cartridge did not load into drive
F3h	Drive power cycled because cartridge popped out after load
F4h	Drive power cycled because drive did not become ready after load
F5h	Drive power cycled because cartridge could not be ejected
F7h	Drive power removed because drive was taken off-line
F8h	Drive power applied because drive was brought back on-line
F9h	Drive power cycled because drive SCSI ID was changed

Init/Rec equals a bit of one if the library system initialize and recovery sequence is to be recorded, or a bit of zero if the initialize and recovery sequence is not to be recorded.

The initialize and recovery sequence consists of one byte values all of which are less than 100.

Finally, the following bytes are always recorded for a non-zero Event History Type.

FEh	SCSI bus or device reset
FFh	Power-on

6. Error Codes

6.1 Medium Changer Device SCSI Error Codes

The following is a list of error codes returned by a Request Sense command issued to the medium changer device within the library. The codes are listed in ASC, ASCQ order. See the Request Sense command, Section 4.16, for a description of the Sense Key values. Errors listed here with a Sense Key of 04h, hardware error, may also be returned with a Sense Key of 01h, recovered error. This indicates that the command was successful although the library did have some difficulty in completing the command. Recovered errors indicate a possible problem with the library.

Error codes returned by optical drives within the library system are not listed — see the appropriate drive manuals for a description of these errors.

Also listed are the internal error codes associated with the SCSI error returned, and the procedures that a host may use to recover when it has received one of the errors listed here. See Section 6.3 for a list of the internal library error codes, and the M500 User's Manual or Service Manual for the cause or corrective action for each code. Refer to the next section for a list of the suggested host error recovery procedures. Not all errors have host recovery procedures. It should be noted that the library system attempts extensive error recovery on its own.

Sense Key	ASC	ASCQ	Error Description	Internal Error	Recovery Procedure
02h	04h	01h	Logical Unit is in process of becoming ready	-	1
05h	1Ah	00h	Parameter list length error	-	2
05h	20h	00h	Invalid command operation code	-	2
05h	21h	01h	Invalid element address	-	2
05h	24h	00h	Invalid field in CDB	-	2
05h	25h	00h	Logical Unit not supported	-	3
05h	26h	00h	Invalid field in parameter list	-	4
05h	28h	01h	Import/Export element accessed	-	5
06h	29h	00h	Power-on, Reset, or Bus Device Reset occurred	-	6
06h	2Ah	00h	Log Parameters changed	-	7
06h	2Ah	01h	Mode parameters changed	-	8
05h	3Bh	0Dh	Medium destination element full	1Ch	9
05h	3Bh	0Eh	Medium source element empty	1Bh	9
05h	3Dh	00h	Invalid bits in identify message	-	10
04h	40h	00h	Diagnostic failure (EPROM)	-	10
04h	43h	00h	Message error	-	10
04h	44h	00h	Internal target failure	-	10
04h	45h	00h	Select or Reselect failure	-	10
04h	47h	00h	SCSI parity error	-	10
04h	48h	00h	Initiator detected error message received	-	10
04h	49h	00h	Invalid message error	-	10
04h	4Bh	00h	Data Phase error	-	10
05h	53h	02h	Medium removal prevented	2Dh	11
04h	80h	11h	Slave CPU communication failure	11h	10
04h	80h	12h	Park failure	12h	-
04h	80h	15h	Pivot cable failure	15h	-
04h	80h	16h	Drive interface board disconnected	16h	-
04h	80h	17h	Lift cable failure	17h	-
04h	80h	18h	Main harness lower (CJ8) cable failure	18h	-
04h	80h	19h	Main harness upper (CJ1) cable failure	19h	-
04h	80h	1Ah	Drive not installed	1Ah	12

Sense Key	ASC	ASCQ	Error Description	Internal Error	Recovery Procedure
04h	80h	1Dh	Element unexpectly empty	1Dh	9
04h	80h	1Eh	Element unexpectly full	1Eh	9
04h	80h	20h	Pick disk failure	20h	13
04h	80h	21h	Store disk failure	21h	13
04h	80h	22h	Drive cable disconnected	22h	-
04h	80h	23h	Drive not ready	23h	14
04h	80h	24h	Drive load failure	24h	15
04h	80h	25h	Drive unload failure	25h	16
04h	80h	26h	Eject failure	26h	16
04h	80h	29h	SCSI terminator power is low	29h	-
04h	80h	2Bh	Cannot export cartridge	2Bh	17
02h	80h	2Ch	Mailslot is open	2Ch	18
04h	80h	2Fh	Pivot failure	2Fh	19
04h	80h	31h	Lift home failure	31h	20
04h	80h	32h	Lift position failure	32h	21
04h	80h	33h	Cartridge projecting from slot or drive	33h	-
04h	80h	34h	Pivot not aligned	34h	-
04h	80h	35h	Flip failure	35h	-
04h	80h	36h	Flip timeout	36h	-
04h	80h	37h	Flip align failure	37h	-
04h	80h	38h	Flip not aligned	38h	22
04h	80h	3Ah	Slider home failure	3Ah	-
04h	80h	3Bh	Slider position failure	3Bh	9,13
04h	80h	3Ch	Swap slider failure	3Ch	23
04h	80h	3Dh	Slider load failure	3Dh	15
04h	80h	3Eh	Slider jammed	3Eh	23
04h	80h	3Fh	Slider misposition	3Fh	24
04h	80h	40h	Pivot align failure	40h	-
04h	80h	43h	Cannot open mailslot	43h	25
04h	80h	45h	Element scan fail	45h	-
06h	80h	46h	SRAM reset	46h	6
02h	80h	4Ah	Front door is open	4Ah	-
04h	80h	51h	Mailslot motor home failure	51h	25
04h	80h	52h	Cannot close mailslot	52h	25
04h	80h	54h	Bad drive type cable	54h	-
05h	80h	55h	Drive address conflict	55h	26
06h	80h	56h	Overheat condition inside cabinet	56h	27
04h	80h	57h	Mailslot sensor fail	57h	-
04h	80h	58h	Mailslot jammed	58h	-
04h	80h	59h	Power supply failure	59h	28
04h	80h	60h	Drive power disconnected	60h	-
05h	86h	00h	Transport element full	1Fh	29

6.2 Medium Changer Device Error Host Recovery Procedures

The following is a list of procedures that a host could use to recover from the SCSI errors listed in the previous section. In some, if not most cases, no action taken by the host will cause full recovery to take place and the M500 User's Guide or Service Manual should be consulted to determine the ultimate cause or corrective action to be taken to rectify the problem. Many situations call for operator intervention.

Procedure	Description
1	Delay a few seconds and then retry command.
2	Examine command block for errors. Sense data identifies offending byte and field.
3	Examine command block or Identify message for non-zero LUN value.
4	Examine parameter list for errors. Sense data identifies offending byte and field.
5	If Position to Element command, position to mailslot with other transport element or use default transport element address of zero. If Move Medium command, do not attempt to move from mailslot to mailslot with Invert bit set.
6	Determine cause of reset, reselect mode parameters not previously saved, and resubmit command.
7	Issue Log Sense, if desired, to obtain log parameters changed via front panel or by another host, and then resubmit original command.
8	Issue Mode Sense, if desired, to obtain mode parameters changes via front panel or by another host, and then resubmit original command.
9	Issue Initialize Element Status and Read Element Status commands to reinventory library. Note on 3B 0D: if using Rezero to park the library, all drives and slots must be empty first.
10	Issue Bus Device Reset to changer device or assert SCSI bus reset line and retry command.
11	Wait for other host to issue Prevent Allow Medium Removal command to allow access to mailslot, or issue Bus Device Reset to changer device and retry command.
12	Power up the drive and place it on-line via the Mode Select command before trying to move to or from it.
13	Issue Position to Element command to any storage element with the Invert bit set. This causes the transport element to be placed in the flipped position. Retry the move or exchange command. If this does not work, specify a transport element address other than zero in the move or exchange command. Use the medium transport element not active at the time that the error occurred. The medium transport element that was active is identified in the Request Sense return data. Note: specifying a non-zero transport element address in the Exchange Medium command may allow the library to operate but at reduced performance.
14	Reload drive by issuing a Move Medium command with the drive as the source and destination address. If this does not work, load the drive and then use the Mode Select command, Drive Assignments Page, to first power-off the drive and then, after a few seconds, to power-on the drive again. Wait a few seconds before issuing a Test Unit Ready to the drive to check for ready status.
15	Specify a non-zero transport element address in the move or exchange command. Use the medium transport element not active at the time that the error occurred. The medium transport element that was active is identified in the Request Sense return data. If this does not work, issue the Initialize Element Status and Read Element Status commands to reinventory the drives. If the drive is truly empty, issue the Mode Select command with the Drive Assignments page to cycle power to the drive as in procedure 14 and then reinventory the drives. Setting the NoScanSE bit in the Mode Select Vendor Unique Special Modes Page will make drive reinventory go faster.
16	Issue the Initialize Element Status and Read Element Status commands to reinventory the drives. If the drive is truly full, issue the Mode Select command with the Drive Assignments page to cycle power to the drive as in procedure 14 and then reinventory the drives. Setting the NoScanSE bit in the Mode Select Vendor Unique Special Modes Page will make drive reinventory go faster.
17	If Rezero Unit command, move cartridges from medium transport elements and drives before issuing command, or set Limited Recovery flag using Mode Select command before issuing command. If not Rezero Unit, move cartridge from mailslot and and then retry command.
18	Issue Open/Close Mailslot command to close the mailslot and then retry command.

Procedure	Description
19	Issue Position to Element command to pivot to column further away than desired destination and then retry command.
20	Issue Open/Close Mailslot command to close the mailslot and then retry command.
21	If a medium transport element is full, move the cartridge to the nearest element and then retry the command. This will lighten the transport assembly.
22	Issue a Position to Element command and then retry the original command.
23	Specify a non-zero transport element address in the move or exchange command. Use the medium transport element active at the time that the error occurred. The medium transport element that was active is identified in the Request Sense return data. Note: specifying a non-zero transport element address in the Exchange Medium command may allow the library to operate but at reduced performance.
24	Issue a Rezero Unit command and then retry the original command.
25	Issue a Position to Element command to move away from the mailslot and then issue an Open/Close Mailslot command to open or close the mailslot.
26	Issue a Mode Sense command with the Drive Assignments page to determine the SCSI ID's of on-line drives and then issue the Mode Select command with the same page to set the SCSI ID of the drive to be powered-on to a non-conflicting address (and non-conflicting with the medium changer device if on the same SCSI bus). Finally, issue a Mode Select command with the same page to power-on the drive.
27	Decrease drive read/write activity until cabinet temperature has cooled down significantly. Use the Mode Select command to power-down unused drives. The internal cabinet temperature can be read using the Mode Sense command.
28	Use drives attached to a different power supply. Drives 2 and 4 are attached to power supply 1; drives 1, 3, 5, and 6 are attached to power supply 2.
29	Use the Move Medium command to move the cartridge out of the medium transport element.

6.3 Internal Error Codes

The following error codes are stored in the library system error log and error statistics buffers and are returned by the Log Sense command. For more information about the causes and corrective actions for these errors, refer to the M500 User's Guide or Service Manual.

Error Code	Error Description
11h	Slave CPU communication failure
12h	Park failure
15h	Pivot cable failure
16h	Drive interface board disconnected
17h	Lift cable failure
18h	Main harness lower (CJ8) cable failure
19h	Main harness upper (CJ1) cable failure
1Ah	Drive not installed
1Bh	Source is empty
1Ch	Destination is full
1Dh	Element unexpectedly empty
1Eh	Element unexpectedly full
1Fh	Lift is full
20h	Pick disk failure
21h	Store disk failure
22h	Drive cable disconnected
23h	Drive not ready
24h	Drive load failure
25h	Drive unload failure
26h	Eject failure
28h	Can't inquiry drive
29h	SCSI terminator power is low

Error Code	Error Description
2Bh	Cannot export cartridge
2Ch	Mailslot is open
2Dh	Medium removal is prevented
2Fh	Pivot failure
31h	Lift home failure
32h	Lift position failure
33h	Cartridge projecting from slot or drive
34h	Pivot not aligned
35h	Flip failure
36h	Flip timeout
37h	Flip align failure
38h	Flip not aligned
3Ah	Slider home failure
3Bh	Slider position failure
3Ch	Swap slider failure
3Dh	Slider load failure
3Eh	Slider jammed
3Fh	Slider misposition
40h	Pivot align failure
43h	Cannot open mailslot
44h	MTE not at drive
45h	Element scan fail
46h	SRAM reset
4Ah	Front door is open
51h	Mailslot motor home failure
52h	Cannot close mailslot
53h	Mailslot reserved
54h	Bad drive type cable
55h	Drive address conflict
56h	Overheat condition inside cabinet
57h	Mailslot sensor fail
58h	Mailslot jammed
59h	Power supply failure
60h	Drive power disconnected
F1h	SCSI bus unavailable
F2h	SCSI selection timeout
F3h	More than 2 ID’s on bus
F4h	Undefined SCSI phase
F5h	SCSI phase error
F6h	Bus not terminated
F7h	SCSI parity error
F8h	Unexpected loss of busy
F9h	Abort message received
FAh	Improper message received
FBh	Two devices responding to same selection
FCh	SCSI timeout
FEh	Drive is busy
FFh	Cannot get SCSI sense code

6.4 Error Code F1h–FFh Internal Error Locations

Error codes F1h-FFh are reserved for low-level SCSI communication errors. To assist in isolating the bus phase in which one of these errors occurs, an internal error location is stored in the Log Sense/Request Sense second Additional Information bytes (except error FEh, in which case the SCSI Status byte is saved instead).

Error Location	Description
1	Selection phase (host selecting changer).
2	Receiving the disconnect message (from the host).
3	Checking for reselection by drive or selection by another initiator while busy processing a command (drive-changer or other initiator-changer).
4	Reselection phase (changer reselecting host).
10	Command phase (host-changer nexus).
11	Data out phase (host-changer nexus).
12	Message out phase (host-changer nexus).
13	Status phase (host-changer nexus).
14	Data in phase (host-changer nexus).
15	Message in phase (host-changer nexus).
20	Command phase while disconnected and busy (other initiator-changer nexus).
21	Data out phase while disconnected and busy (other initiator-changer nexus).
22	Message out phase while disconnected and busy (other initiator-changer nexus).
23	Status phase while disconnected and busy (other initiator-changer nexus).
24	Data in phase while disconnected and busy (other initiator-changer nexus).
25	Message in phase while disconnected and busy (other initiator-changer nexus).
30	Arbitration phase (changer arbitrating for bus).
31	Selection phase (changer selecting optical drive).
32	Waiting for new information transfer phase (changer-drive nexus).
40	Command phase (changer-drive nexus).
41	Data out phase (changer-drive nexus).
42	Message out phase (changer-drive nexus).
43	Status phase (changer-drive nexus).
44	Data in phase (changer-drive nexus).
45	Message in phase (changer-drive nexus).